

NASA TECH BRIEF



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Sonic Boom Propagation in Stratified Atmosphere

The problem:

A need exists for a comprehensive analysis and algorithm, realized in a practicable computer program, which would provide realistic calculations for sonic boom signatures in the atmosphere.

The solution:

A versatile computational technique to solve sonic boom equations required in the design and operation of supersonic aircraft has been developed.

How it's done:

Earlier algorithms for sonic boom have used various simplifying assumptions. A basic aim of the present algorithm has been to avoid these assumptions as far as possible and to extend the cases which could be considered. The present algorithm includes the following features: the inclusion of maneuvering aircraft, in planes other than the vertical and horizontal, in a sonic boom pressure calculation; an appropriate ray-tube area calculation based on linear geometric acoustics; and results in the form of complete signatures, without far-field n-wave assumptions, obtained through the use of an "age" variable in the calculation of nonlinear effects.

The present algorithm assumes a horizontally stratified atmosphere with horizontal winds but without turbulence. Although this assumption does not account for signature peaking and rounding due to turbulence, it simplifies the calculations and does correspond to cases of great practical interest, including the nominal values for standard conditions.

The analysis is largely a rational synthesis of existing acoustic theories described in the documentation, with some new theoretical development. The program has been written with flexibility as a primary goal. It is designed for use on a wide variety of modern computers and for application to a variety of problems.

It was developed using an IBM-1130, Model 2B, and then modified for and operated with CDC-6600. The program may be altered to accommodate the operating system constraints of a particular computer through simple changes in input-output unit designation. It may also be necessary to modify the program structure from subprogram linkage to main program linkage to meet core storage requirements, as in the case for the IBM-1130.

The airplane F-function is one of the primary inputs. Several other input options have been provided. There are choices in the specifications of input and output units; how the atmosphere is to be specified; and how certain maneuver time derivatives are to be obtained from input data.

Notes:

1. The program is written in ASA FORTRAN IV language for use on the IBM-1130 or CDC-6600 computers. Details are given in NASA CR's 1299 and 66756.
2. Inquiries should be made to:
COSMIC
Computer Center
University of Georgia
Athens, Georgia 30601
Reference: B69-10391

Patent status:

No patent action is contemplated by NASA.

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